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METHOD FOR DETERMINATION OF POROSITY OF PAPER

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METHOD FOR DETERMINATION OF POROSITY OF PAPER

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METHOD FOR DETERMINATION OF POROSITY OF PAPER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 November 1984, after the draft finalized by the Paper and its Products (Excluding Packaging Materials) Sectional Committee had been approved by the Chemical Division Council.

0.2 The method prescribed in this standard consists in measuring the air permeability and for each test unit the porosity is reported as the average time required to displace 100 ml of air through an area of $6{\cdot}45\ \text{cm}^2$ of the paper.

0.3 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS :2-1960*.

1. SCOPE

1.1 This standard prescribes the method of test for porosity of paper.

1.2 This method is applicable to papers and boards that (under the conditions specified) permit the passage of 100 ml of air in 5 to 1 800 seconds. This method is not suitable for rough-surface papers such as creped and corrugated papers, which cannot be securely clamped to avoid leakage.

2. APPARATUS

2.1 Air Resistance Apparatus† — The apparatus consists of an outer cylinder which is partly filled with oil, and an inner cylinder, having an open or closed top, sliding freely in the outer cylinder. Air pressure provided by the mass of the inner cylinder is applied to the specimen held between clamping plates through a circular orifice having an area of 6·45 cm”. The clamping plates may be at the top of the inner

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‘Rules for rounding off numerical values (*revised*).

†The instrument prescribed is the Gurley instrument.

cylinder (Fig. 1), or may preferably be mounted on the base of the apparatus (Fig. 2). An elastic gasket which is attached to the clamping plate on the side exposed to air pressure prevents leakage of air between the surface of the paper and the clamping plate.

2.2 The gasket consists of a thin, elastic, oil-resistant non-oxidizing material having a smooth surface (see Note). The inside diameter of the gasket is 28·6 ± 0·1 mm and the outside diameter 34·9 ± 0·1 mm. The aperture in the gasket is accurately aligned with the aperture in the clamping plates. To align and protect the gasket in use, it is cemented in a groove machined in the clamping plate. The groove is concentric with the aperture in the opposing plate. It is 28·4 ± 0·04 mm in internal diameter and 0·45 ± 0·05 mm deep. Its outside diameter is 35·14 ± 0·04 mm for convenience in inserting and attaching the gasket.

NOTE -A moulded polished plate, 0·8 mm thick 50 to GO IRHD is satisfactory.

2.3 The outer cylinder is 25·4 cm high with an internal diameter of 82·6 mm. It has four vertical bars, each 245·5 mm long and 2·4 mm in diameter, mounted equidistantly on the inner surface of the outer cylinder to serve as guides for the inner cylinder. The inner cylinder is made ofaluminium or its alloy graduated in units of 50 ml, and has a range of 350 ml. The volume tolerance is 0·5 percent. It is 25·4 cm high, and has an external diameter of 76·2 mm and an internal diameter of 74·1 mm. It weighs 567·0 ± 0·5 g, so as to produce a pressure of 12·4 cm of water.

NOTE — Some inner cylinders are also graduated in units of 25 ml for the first 100 ml, and have an additional graduation at 400 ml.

2.4 **Timer** — Stopwatch, electric or electronic timer, capable of recording time to the nearest 0·2 second.

2.5 **Materials** -The outer cylinder is filled with a lubricating oil having a viscosity of 10 to 13 cSt at 38°C and a flash point of at least 135°C.

NOTE -A light spindle oil is suitable for this purpose. Oil is used in preference to water because it does not affect the moisture content of the specimen nor does it corrode the aluminium inner cylinder. The oil should not contain any easily volatile fraction, and for that reason, a minimum flash point is specified.

2.6 **Calibration** — Test the apparatus for air leakage by clamping a thin piece of smooth impervious metal foil, cellulose or polyethylene film between the orifice plates, using the method prescribed in 2.8.2 to 2.8.5. A maximum leakage of 50 ml in 5 hours is allowable.

‘2.7 **Test Specimens** — From the sample select specimens which are undamaged and free from manufacturing defects. Ensure that the dimensions of pieces are at least 50 mm in both directions.

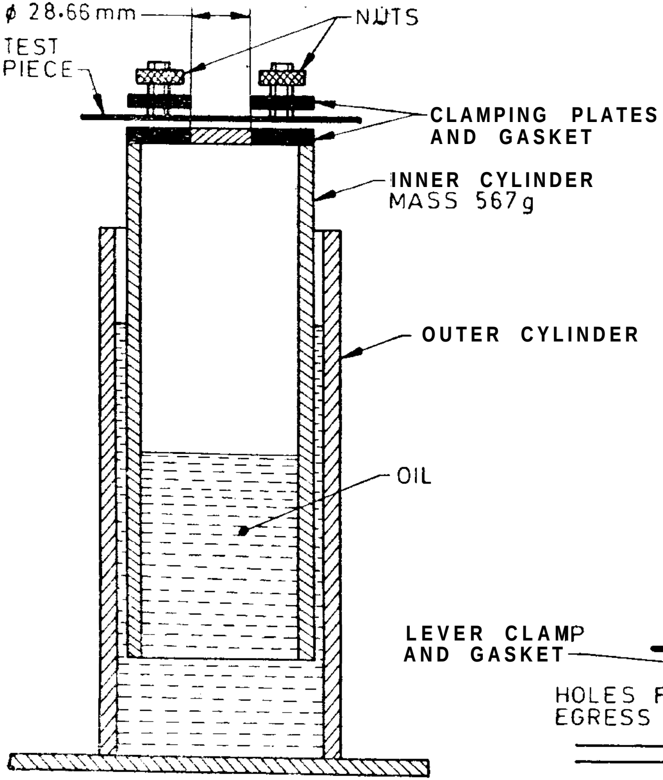

FIG. 1 POROSITY (GURLEY) APPARATUS WITH CLAMPING PLATES AT THE TOP OF INNER CYLINDER

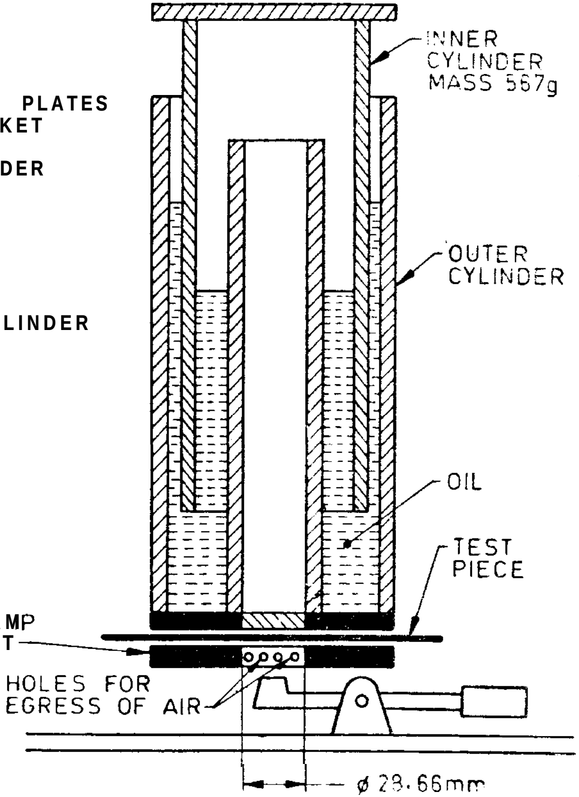

FIG. 2 POROSITY (GURLEY) APPARATUS WITH CLAMPING PLATES MOUNTED ON THE BASE OF APPARATUS

2.8 Procedure

2.8.1 Condition the test specimens in an atmosphere having 27 ± 2°C temperature and relative humidity of 65 ± 2 percent.

2.8.2 Place the instrument on a level surface so that the cylinders are vertical. Fill the outer cylinder with oil to a depth of about 12·5 cm as indicated by a ring marked on the inner surface of the cylinder.

2.8.3 For the instrument having the clamp at the top of the inner cylinder, raise the inner cylinder with one hand and clamp the specimen with the other. Then lower the inner cylinder and allow it to float in the oil. Alternatively, remove the inner cylinder, clamp the specimen and lower the cylinder gently in the outer cylinder.

NOTE-The proper procedure is to tighten the nuts alternatively so that the clamping pressure is equal on both sides.

2.8.4 For the instrument having the clamp on the base, raise the inner cylinder until its rim is supported by the catch, clamp the specimen between the clamping plates and then lower the inner cylinder gently until it floats.

2.8.5 As the inner cylinder moves steadily downwards, determine the number of seconds, to the nearest 0·2 second, required for the first two consecutive 50 ml intervals to pass the rim of the outer cylinder, starting at the zero point. In cases where a steady movement of the inner cylinder is not attained before the zero mark is reached, timing may be started at the 50 ml mark.

NOTE — Avoid subjecting the apparatus to vibrations, as this increases the rate of air displacement.

2.8.6 Perform at least five tests with felt side up and five tests with wire side up and average the results.

2.9 **Report** -For each test unit, report the porosity as the average time in seconds required to displace 100 ml of air through an area of 6·45 cm^2 of the paper. Report to the nearest second.